Progress Report

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of the Chesapeake Watershed Cooperative Ecosystem Studies Unit

Project Title

Proposal to Conduct Mammal Surveys in George Washington Birthplace NM, Thomas Stone NHS, Colonial NHP, Fredericksburg and Spotsylvania NMP, and Richmond NBP

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Project Overview

The National Park Service (NPS) has identified the need for surveys of mammals in 3 coastal and 2 mid Atlantic national parks in the Northeast Region. Acquiring such natural resource information is in compliance with the Vail Agenda mandate to the NPS's Natural Resource Inventory and Monitoring Program (NPS 1998). One of the 5 long-term goals established by this program is to complete baseline inventories of basic biological and geophysical natural resources for the national parks. During Phase 1 of the natural resource inventory the NPS has set an objective of documenting the presence of at least 80% of all plant and animal species (excluding invertebrates) occurring within a park's boundaries; the stated objective for the mammal survey of the parks of the Northeast Region is 90%. Surveys will confirm the existence of currently listed species and document the presence of new ones. The data collected provide important baseline information that can be used by natural resource specialists in monitoring programs to note changes and quantify trends in resources and relate variation in time to potential causes. Such monitoring programs can result in management decisions that effect proper stewardship of the park system by NPS.

I proposed to conduct surveys of mammals (except Chiroptera) in 3 coastal parks - George Washington Birthplace National Monument (GEWA), Thomas Stone National Historic Site (THST), and Colonial National Historical Park (COLO) – and 2 mid Atlantic parks - Fredericksburg and Spotsylvania Co. Memorial National Military Park (FRSP) and Richmond National Battlefield Park (RICH) - beginning in 2002. GEWA consists of 551 acres (223 ha) on the coastal plain east of Fredericksburg, Virginia, in Westmoreland County. The monument was authorized in 1930 and opened under the administration of the NPS in 1932. THST consists of 297 acres (120 ha) in Charles County, Maryland, approximately 4 miles west of La Plata and 25 miles south of Washington, D.C. The park opened in 1992. COLO encompasses approximately 9,327 acres (3,776 ha). It is located in southern, coastal tidewater Virginia and is composed of Jamestown Island, Yorktown Battlefield, and the 23-mile (38-km) Colonial Parkway that connects the island and battlefield. COLO was designated a national park in 1936. FRSP is comprised of 6,789 acres (2,749 ha) within 9 units in and west of Fredericksburg, Virginia, in Spotsylvania, Stafford, Orange and Caroline counties. The park was established in 1927. RICH occupies 1,414 acres (572 ha) within 12 separate units in and east of Richmond, Virginia, in Hanover, Chesterfield and Henrico counties. The park was established in 1936.

Because inventory activities began only at THST, GEWA and COLO in 2002, what follows in this report are descriptions of our activities only for those parks.

Preliminary Activities

Development of MS Access field forms.-Frostburg State University (FSU) graduate assistant, Tressa Dolbeare, and NPS Coastal and Barrier Network Data Manager, Sara Stevens, interacted from January 2002 to April 2002 to develop a MS Access data entry system that could be used as the model for this project and mammal inventory projects at other national parks. The system consists of a series of field forms, each with multiple data-entry fields (see attached file), that can capture all of the information needed for the deliverable products (Barry 2001) required of the project.

Research permits.-We obtained a Virginia Scientific Collecting Permit on 21 May 2002 and a research permit to conduct the mammal inventory at THST and GEWA on 22 May 2002. The effective date of the research permit to conduct the mammal inventory at COLO was 10 July 2002.

Meetings with NPS Resource Management personnel.-An initial meeting between Natural and Cultural Resources Program Manager Rijk Morawe of THST and GEWA and principal investigator (cooperator) Ron Barry was held on 1 and 2 August 2001. The main purposes of this meeting were to become acquainted with the parks and discuss how park and FSU personnel could cooperate to facilitate the achievement of the main objective of the project, a documentation of the mammals present in the parks. A second meeting was held on 22 May 2002. Present were Mr. Morawe, Dr. Barry, and graduate assistant Tressa Dolbeare. Mr. Morawe gave Ms. Dolbeare and Dr. Barry a tour of THST and GEWA, with special attention afforded the different macrohabitats that should be surveyed for mammals. Additional topics of discussion included park and NPS regulations (e.g., research permits), accommodations (dorm space) for Ms. Dolbeare, interaction of FSU personnel with THST and GEWA personnel, scheduling of field activities by FSU personnel, on-site storage of field equipment, etc.

An initial meeting between Natural Resource Manager Charles Rafkind of COLO and Dr. Barry was held on 3 August 2001. Again, the general purposes of this meeting were to become acquainted with the parks and discuss how park and FSU personnel could cooperate to achieve the main objective of the project, a documentation of the mammals present in the parks. A second meeting was held on 21 September 2002. Present were Mr. Rafkind, Dr. Barry, and FSU graduate assistants Dana Strang, Heather Warchalowski, and Tressa Dolbeare. Mr. Rafkind gave Mss. Strang, Warchalowski, and Dolbeare and Dr. Barry a tour of the components of COLO, with particular attention afforded the different macrohabitats that should be surveyed for mammals. Additional topics of discussion included park and NPS regulations (e.g., research permits), U.S. Navy requirements for field studies at Cheatham Annex, accommodations (dorm space) and keys for Mss. Strang and Warchalowski, interaction of FSU personnel with COLO personnel, use by FSU personnel of the information retrieval capabilities of Mr. Rafkind's office, scheduling of field activities by FSU personnel, storage of on-site field equipment, etc.

Acquisition of historical records.-Publications, park records, and the secure NPSpecies database (https://science1.nature.nps.gov/npspecies) records were obtained for each of the parks. The NPSpecies database was accessed in January 2003 for the most current information. No records exist for THST. The 22 species of mammals recorded in the NPSpecies database for GEWA resulted from a survey conducted by Painter and Eckerlin (1993). Seven orders and 13 families are represented among these species (Table 1), according to current taxonomy (Jones et al. 1997; Wilson and Reeder 1993). Seven orders and 14 families are represented among the 37 mammal species currently listed in NPSpecies for COLO. In addition, Bradshaw (1999) reported a single specimen of *Sigmodon hispidus* (hispid cotton rat: Rodentia, Muridae) in the Green Spring Unit of COLO, and Brustlin Inc. (1996) listed *Tamias striatus* as present in COLO (Table 2). Chazal and Van Alstine (2002) reported that *Sorex hoyi* (pygmy shrew: Insectivora, Soricidae) and *Eptesicus fuscus* (big brown bat: Chiroptera, Vespertilionidae) were listed previously (March 2001) in NPSpecies for COLO and that they are likely residents. However, the presence of these species is not corroborated by other databases, and they are not listed currently in NPSpecies. Chazal and Van Alstine (2002) reported that *Blarina carolinensis* (southern short-tail shrew: Insectivora, Soricidae) had been listed in NPSpecies, but its presence is not corroborated by other databases, it was not considered a resident of the park by these authors, and is not currently listed.

Equipment and supplies purchased.-Equipment and supplies were purchased for capturing and recording mammals at THST, GEWA and COLO. Traps included foldable Sherman small mammal live traps and muskrat-size, raccoon-size, and bobcat-size Tomahawk live traps (Table 3). Associated supplies included flags, flagging, and spring scales. TrailMaster remote camera kits, including monitors, data collector, software, and storage and carrying (pistol) cases, were purchased for recording medium- and large-sized species. A digital camera and charger were purchased to obtain photographic voucher specimens, images of live-captured specimens of questionable identity, photographs of unusual or rare species, and images for identification of amphibians and reptiles captured in pitfall traps (to aid in the ongoing survey of these species). Two laptop computers and associated software were procured for use in the field and away from the office (meetings, etc.). Greatest use of computers will involve on-site data recording of mammals trapped, sighted, and photographed.

Initial Field Work

Trapping results at THST and GEWA.-Sampling using Sherman and raccoon-sized Tomahawk live traps was conducted during 18 sampling periods from May through November. Nine sampling occasions were used in each park (Table 4). Six macrohabitats, broadly characterized as managed field, disturbed forest, deciduous forest, mixed forest, pine plantation, and wetland, were sampled for mammals. An approximately 75-m swath of deciduous forest habitat severely wind-damaged from a recent (2001) tornado constituted the disturbed habitat. Depending on the configuration of the area, grids (12) and transects (6) were used for sampling. Trapping and animal handling methods followed those described by Barry (2001). Sherman trap interval was 10 m for all transects and grids. GPS coordinates (not differentially corrected) for sampling locations in THST and GEWA were obtained using a Garmin 12 GPS unit.

Trapping effort at the 2 parks totaled 3,096 trap nights with Sherman traps and 176 trap nights with Tomahawk traps (Table 4). Fifty-three individual mammals representing 4 species were captured a total of 93 times with recaptures.

Sampling totaled 1,814 trap nights with Sherman traps and 88 trap nights with Tomahawk traps at THST (Table 4), where 4 species of mammals were captured a total of 41 times at 4 of the 8 different locations (Table 5). *Peromyscus leucopus* was the most common small mammal captured in forest habitat and the only mammal captured in the disturbed forest habitat. *Microtus pennsylvanicus* was the only small mammal caught in fields, and at only 1 of the 3 fields trapped. *Blarina brevicauda* and *Procyon lotor* were captured only in forested habitat.

Trapping at GEWA totaled 1,282 trap nights with Sherman traps and 88 trap nights with Tomahawk traps (Table 4). Four species of mammals were captured a total of 52 times at 6 of the 9 sampling locations (Table 5). *P. leucopus* was the most common small mammal captured in forest habitat and the pine plantation. This species was the only mammal captured in wetland habitat. *M. pennsylvanicus* was the only small mammal caught in fields, and at only 1 of the 3 fields trapped. *P. lotor* was captured only in the pine plantation, and *B. brevicauda* only in 1 of the mixed forest habitats. Also, in response to complaints from park employees about a fox eating many birds in the historical area, 1 bobcat-size Tomahawk trap was set in the bird yard at the historical site for 4 days in July, with no results. However, on 30 July, 1 female *Didelphis virginiana* with a large juvenile

"in tow" was captured near a fox den in the horse pasture about 5 m from the edge of the woods at GPS zone 18 S location 0331810 4228086.

Trapping results at COLO.-Five transects were established for preliminary trapping activities during October and November at COLO. Approximate coordinates derived from ArcView/ArcMap are presented for these transects. On 19 October 2002 1 transect of 10 Sherman traps was established off Colonial Parkway in an unmowed field (approximate UTM zone 18 S coordinates: 0360769 4125869), and another transect of 20 Sherman traps was situated among pines (*Pinus* sp.) and holly (*Ilex opaca*) approximately 50 m from the roadside (approximate UTM zone 18 S coordinates: 0363035 4124630). Transects were run for 1 night, and no captures resulted. On 8 November 2002 3 transects were established in deciduous forest (*Acer* sp., *Quercus* spp.) with sparse understory near a dam on Wormley Pond. One transect of 30 Sherman traps was located at the bottom of a ravine near water in wet soil (approximate UTM zone 18 S coordinates: 0367530 4119454). Another transect of 20 Sherman traps was placed nearby at the top of the ravine in dry forest (approximate UTM zone 18 S coordinates: 0367482 4119641). Traps were open in these 2 transects on 8 and 9 November 2002. The 3rd transect of 30 Sherman traps was situated approximately 50 m into the forest from the top of the ravine in dry forest (approximate UTM zone 18 S coordinates: 0367440 4119568); traps in this transect were open only 1 night. Trap nights totaled 160 in the 5 transects. No mammal captures resulted in any of the transects.

Observations of mammals and mammal sign.-Twelve species of mammals (or their sign) were sighted in THST and GEWA between May and November 2002; 10 species each were observed in the 2 parks, and 8 species were observed in both parks (Table 6). Three species were recorded by remote camera in GEWA; *P. lotor* and *Odocoileus virginianus* were recorded in September, and these same 2 species plus 1 *P. leucopus* in the mouth of an owl (barred owl, *Strix varia*?) were photographed in November. In October 2002, 4 species were sighted in COLO (Table 6).

Discussion

Initial project activities involved meeting park resource managers, becoming familiar with the parks and their macrohabitats, obtaining permits, purchasing and receiving equipment and supplies for sampling, and researching the literature and appropriate web sites for historical records of mammals in the parks. Sampling began in May at THST and GEWA, and preliminary activities began in October in COLO.

An examination of relevant literature and NPSpecies databases permitted the compilation of species tabulated in this report for GEWA and COLO. Our list of species recorded for COLO numbers 39, 2 more than the 37 (including 2 subspecies of *P. leucopus*) listed currently in NPSpecies. No additional species were recorded for either of these parks as a result of sampling activities during 2002. However, 10 species have now been recorded for THST from trapping and observation activities undertaken to date, and voucher specimens (or voucher photographs or hair samples) will be obtained for these and any additional species recorded during 2003. Precise locations and dates for species sighted (or whose sign has been observed) will be submitted in digital format with trapping records in the final report (or upon request at an earlier date).

Low numbers and diversity of species from our trapping effort and observations in THST and GEWA in 2002 do not permit the generation of meaningful indices of abundance or diversity, or

statistical comparisons among macrohabitats. Our sampling effort encompassed only slightly more than 3,000 Sherman trap nights and less than 200 Tomahawk trap nights in these 2 parks. Muskrat- and bobcat-size Tomahawks have not yet been used systematically, and we are still on a steep learning curve with the TrailMaster remote camera equipment. Severe drought in the area no doubt contributed to the relatively low trap success in the summer and fall of 2002. In part, the lack of numbers and diversity also can be attributed to our inability to coordinate the establishment of pitfall trap arrays with park personnel; pitfall traps are much more effective than Sherman traps at capturing shrews and other mammals < 10 g in body mass (Kirkland and Sheppard 1994). We anticipate that several additional species of shrews will be added to the lists of mammals in THST and GEWA.

Only a very preliminary trapping effort began in COLO in 2002, encompassing few trap nights (160 total) during 2 brief sampling occasions in the fall. Sampling will begin in earnest in late winter – early spring in 2003 in COLO and continue through 2004. Based on historical records and the diversity of habitats, we anticipate high mammal species diversity, although Bradshaw (1999) found that even very common species in the Green Spring Unit of the park exhibited very low capture success. When sampling resumes, more precise locations of the transects described herein will be obtained on-site and reported in future reports.

Future work will include characterizations of habitat and determine relative abundances, habitat associations and distributions, species diversity and associated measures of richness and evenness for nonchiropteran mammal species in the parks. Data are being recorded in MS Access for submission with the final report to the NPS I & M program.

Literature Cited

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Table 1. Historical record of mammals found at George Washington Birthplace National Monument (GEWA). See text for citations. Taxonomy follows Wilson and Reeder (1993) and Jones et al. (1997).

Order	Family	Species	Common name
Didelphimorphia	Didelphidae	*Didelphis virginiana*	Virginia opossum
Insectivora	Soricidae	*Blarina brevicauda*	Northern short-tail shrew
	Talpidae	*Scalopus aquaticus*	Eastern mole
Chiroptera	Vespertilionidae	*Eptesicus fuscus*	Big brown bat
		Lasionycteris noctivagans	Silver-haired bat
Lagomorpha	Leporidae	*Sylvilagus floridanus*	Eastern cottontail
Rodentia	Castoridae	*Castor canadensis*	Beaver
	Muridae	*Microtus pennsylvanicus*	Meadow vole
		Microtus pinetorum	Pine vole
		Ondatra zibethicus	Muskrat
		Mus musculus	House mouse
		Rattus norvegicus	Norway rat
		Oryzomys palustris	Marsh rice rat
		Peromyscus leucopus	White-footed mouse
	Sciuridae	*Glaucomys volans*	Southern flying squirrel
		Marmota monax	Woodchuck (groundhog)
		Sciurus carolinensis	Eastern gray squirrel
Carnivora	Canidae	*Urocyon cinereoargenteus*	Gray fox
	Mephitidae	*Mephitis mephitis*	Striped skunk
	Mustelidae	*Mustela vison*	Mink
	Procyonidae	*Procyon lotor*	Raccoon
Artiodactyla	Cervidae	*Odocoileus virginianus*	White-tailed deer

Table 2. Historical record of mammals found at Colonial National Historical Park (COLO). See text for citations. Taxonomy follows Wilson and Reeder (1993) and Jones et al. (1997).

Order	Family	Species	Common name
Didelphimorphia	Didelphidae	*Didelphis virginiana*	Virginia opossum
Insectivora	Soricidae	*Blarina brevicauda*	Northern short-tail shrew
		Cryptotis parva	Least shrew
		Sorex longirostris	Southeastern shrew
	Talpidae	*Condylura cristata*	Star-nosed mole
		Scalopus aquaticus	Eastern mole
Chiroptera	Vespertilionidae	*Lasiurus borealis*	Red bat
		Myotis lucifugus	Little brown bat
		Myotis septentrionalis	Northern Myotis
		Nycticeius humeralis	Evening bat
Lagomorpha	Leporidae	*Sylvilagus floridanus*	Eastern cottontail
		Sylvilagus palustris	Marsh rabbit
Rodentia	Castoridae	*Castor canadensis*	Beaver
	Muridae	*Microtus pennsylvanicus*	Meadow vole
		Microtus pinetorum	Pine vole
		Ondatra zibethicus	Muskrat
		Mus musculus	House mouse
		Rattus norvegicus	Norway rat
		Ochrotomys nuttalli	Golden mouse
		Oryzomys palustris	Marsh rice rat
		Peromyscus gossypinus	Cotton mouse
		Peromyscus leucopus	White-footed mouse
		Reithrodontomys humulis	Eastern harvest mouse
		Sigmodon hispidus	Hispid cotton rat
	Sciuridae	*Glaucomys volans*	Southern flying squirrel
		Marmota monax	Woodchuck (groundhog)
		Sciurus carolinensis	Eastern gray squirrel
		Tamias striatus	Eastern chipmunk
	Dipodidae	*Zapus hudsonius*	Meadow jumping mouse
Carnivora	Canidae	*Canis lupus (familiaris)*	Domestic dog
		Urocyon cinereoargenteus	Gray fox
		Vulpes vulpes	Red fox
	Felidae	*Felix silvestris*	House cat
		Lynx rufus	Bobcat
	Mustelidae	*Lontra canadensis*	River otter
		Mustela frenata	Long-tailed weasel
		Mustela vison	Mink
	Procyonidae	*Procyon lotor*	Raccoon
Artiodactyla	Cervidae	*Odocoileus virginianus*	White-tailed deer

Table 3. Equipment and supplies purchased during 2002 for recording species of mammals at Thomas Stone National Historic Site (THST), George Washington Birthplace National Monument (GEWA), and Colonial National Historical Park (COLO).

Item	Quantity
3 X 3.5 X 9” aluminum foldable Sherman live traps	300
Muskrat-size collapsible Tomahawk live traps	30
Raccoon-size collapsible Tomahawk live traps	6
Bobcat-size collapsible Tomahawk live traps	2
10-g Pesola scale	2
30-g Pesola scale	3
100-g Pesola scale	3
600-g Pesola scale	2
2.5 X 3.5 X 21” flags (bundles of 100)	8
Plastic flagging	12
PC interface cable for GPS unit	1
SONY MAVICA digital camera and charger	1
Gateway DS 450 L laptop computer, software, and 3-yr. warranty	2
TrailMaster TM 35-1 Camera kit	2
TrailMaster TM 1550 Active IR Trail Monitor	2
TM Data Collector	1
TM StatPack Software and Cable	1
Pistol case (for storing and transporting TrailMaster cameras)	2
Assorted supplies (bait, Polyfil, wire, nails, etc.)	-

Table 4. Trapping schedule, locations, habitats, and efforts for 2002 at Thomas Stone National Historic Site (THST) and George Washington Birthplace National Monument (GEWA). Dates are nights traps were open. Disturbed THST habitat was severely wind-damaged deciduous forest (see text). Total number of Sherman traps in a configuration are in parentheses; 4 raccoon-size Tomahawk traps were used at each location where trap nights are indicated for these traps, except for THST DF 3 and GEWA WL 1 where only 3 and 2 Tomahawk traps, respectively, were used. Trap nights are for Sherman live traps, followed by Tomahawk live traps in parentheses. Sherman trap interval was 10 m. DF = deciduous forest, MF = mixed forest, PP = pine plantation, WL = wetland.

Dates (2002)	Park	Habitat/Site	Location (UTM zone 18 S)	Sherman Trap Configuration	Trap Nights
5/22 - 5/23	THST	Field 1	0322488 4266832	3 X 10 grid (30)	60
5/22 - 5/23	THST	Disturbed	0322174 4267105	1 transect (40)	80
5/22 - 5/23	THST	DF 1	0322586 4266123	1 transect (30)	60 (8)
5/28 - 5/31	THST	DF 2	0322221 4267228	1 transect (30)	120 (16)
6/11 - 6/14	THST	DF 3	0322331 4266050	10 X 10 grid (100)	400 (12)
6/25 - 6/28	THST	Field 2	0322508 4266064	5 X 20 grid (100)	400 (16)
7/2 - 7/3, 7/5	THST	Field 3	0322642 4266577	7 X 7 grid (49)	147 (12)
7/2 - 7/3, 7/5	THST	MF 1	0322612 4266763	7 X 7 grid (49)	147 (12)
8/7 - 8/10	THST	DF 3	0322331 4266050	10 X 10 grid (100)	400 (12)
7/16 - 7/19	GEWA	MF1	0331580 4228558	7 X 7 grid (49)	196 (16)
7/16 - 7/19	GEWA	PP1	0332182 4229351	7 X 7 grid (49)	196 (16)
7/23 - 7/26	GEWA	Field 1	0331790 4229083	7 X 7 grid (49)	196 (16)
7/23 - 7/26	GEWA	WL 1	0332829 4229190	1 transect (30)	120 (8)
7/23 - 7/26	GEWA	MF 2	0331895 4228757	7 X 7 grid (49)	196 (16)
7/30 - 8/2	GEWA	Field 2	0331684 4228214	7 X 7 grid (49)	196 (16)
7/30 - 8/2	GEWA	WL 2	0331794 4228128	1 transect (9)	36
9/21 - 9/22	GEWA	DF*	0331728 4228954	7 X 7 grid (49)	98
11/9 - 11/10	GEWA	Field 3**	0330830 4229657	1 transect (24)	48

* Near logged area
** Adjacent to Washingtons' Burial Grounds

Table 5. Capture record for mammals caught in Thomas Stone National Historic Site (THST) and George Washington Birthplace National Monument (GEWA) from May to November 2002. Sherman live traps were used to capture small mammals and Tomahawk traps to capture *Procyon lotor*. TNs = trap nights. See Table 4 for descriptions and locations of habitat/site and numbers of trap nights. Sites from Table 4 not listed here yielded no captures.

Park Habitat/site	Species	No. individuals	Total captures	Captures/100 TNs
THST				
Field 1	*Microtus pennsylvanicus*	4	4	6.7
Disturbed	*Peromyscus leucopus*	3	3	3.8
DF 3	*Peromyscus leucopus*	9	20	2.5
	Blarina brevicauda	3	3	0.4
	Procyon lotor	2	2	8.3
MF 1	*Peromyscus leucopus*	4	9	6.1
GEWA				
MF 1	*Peromyscus leucopus*	6	17	8.7
	Blarina brevicauda	1	1	0.5
PP 1	*Peromyscus leucopus*	5	5	2.6
	Procyon lotor	2	2	16.7
WL 1	*Peromyscus leucopus*	6	14	11.7
MF 2	*Peromyscus leucopus*	5	10	5.1
DF	*Peromyscus leucopus*	1	1	1.0
Field 3	*Microtus pennsylvanicus*	2	2	4.2
Pasture*	*Didelphis virginiana*	2	2	-

* Capture of female and juvenile in 1 trap night using a bobcat-size Tomahawk trap (see text)

Table 6. Mammals (or their sign) sighted in Thomas Stone National Historic Site (THST), George Washington Birthplace National Monument (GEWA), and Colonial National Historical Park (COLO) from May to November 2002. * = photographed by remote camera.

Species	THST	GEWA	COLO
Didelphis virginiana		√	√
Blarina brevicauda	√	√	
Sylvilagus floridanus	√	√	
Microtus pennsylvanicus	√	√	
Peromyscus leucopus	√	√*	
Marmota monax	√	√	√
Sciurus carolinensis	√	√	
Canis lupus (familiaris)	√		
Vulpes vulpes	√		√
Lontra canadensis		√	
Procyon lotor	√	√*	
Odocoileus canadensis	√	√*	√